The pressure, and a possible hidden Hagedorn transition at large-N

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Abstract: In view of recent observations indicating the presence of interesting nonperturbative features above T_c, we numerically study the deconfinement of $SU(N)$ gauge theories with $N \geq 3$. First we focus on the change in bulk thermodynamical properties as T crosses T_c. We find that the pressure for $N = 4$, and $N = 8$ are very close, and not very far from the $N = 3$ result. This seems to indicate that any nonperturbative features seen in the past for $SU(3)$, are present at $N = \infty$ as well, where analytical approaches simplify.

Second we concentrate on the dynamics that drive the transition. Deconfinement naturally arises in models of loops that condense in a second order transition. This may be identified with the "Hagedorn temperature", T_H, conjectured a long time ago for hadronic matter. We find signs for its existence by studying the metastable confined phase at $T > T_c$, for $N = 8, 10, 12$. Since the surface tension increases with N, tunneling to the true vacuum is postponed, and we present estimates for T_H of $N = 12$.